TEXAS AGRICULTURAL EXPERIMENT STATIONS.

BULLETIN No. 44.

JULY, 1897.

PAINTS AND PAINTING MATERIALS

AND

MISCELLANEOUS ANALYSES.

POSTOFFICE:
COLLEGE STATION, BRAZOS CO., TEXAS.

Reports from this Station are sent free to farmers of the State on application to
J. H. CONNELL, DIRECTOR, P. O. College Station, Texas.

AUSTIN:
BEN C. JONES & CO., PRINTERS.
1898

TEXAS AGRICULTURAL EXPERIMENT STATIONS.

OFFICERS.

GOVERNING BOARD.

(BOARD OF DIRECTORS A. & M. COLLEGE.)

HON. F. A. REICHARDT ..... Houston.
HON. W. R. CAVITT ..... Bryan.
HON. F. P. HOLLAND ..... Dallas.
HON. GEO. C. PENDLETON ..... Belton.
HON. CHAS. ROGAN ..... Brownwood.
HON. JEFF. JOHNSON ..... Austin.

STATION STAFF.

THE PRESIDENT OF THE COLLEGE.

J. H. CONNELL, M. SC. ..... Director.
H. H. HARRINGTON, M. SC. ..... Chemist.
M. FRANCIS, D. V. M. ..... Veterinarian.
R. H. PRICE, B. S. ..... Horticulturist.
B. C. PITTUCK, B. S. A. ..... Agriculturist.
P. S. TILSON, M. S. ..... Associate Chemist.
H. NESS, B. S. ..... Assistant Horticulturist.
C. C. TODD, B. S. ..... Assistant Chemist.
H. C. KYLE, B. S. A. ..... Foreman of Farm.
J. G. HARRISON ..... Bookkeeper.

SUPERINTENDENT OF BEEVILLE STATION.

S. A. MCHENRY ..... Beeville, Bee Co.

NOTE.— *The main station is located on the grounds of the Agricultural and Mechanical College in Brazos County. The postoffice address is College Station, Texas.*

PAINTS AND PAINTING MATERIAL.

BY H. H. HARRINGTON AND P. S. TILSON.

The proper and cheap preservation of timber in tenant houses, outhouses, and fences is a practical difficulty constantly presenting itself to the farmer. The first cost of building is of itself a menace to the use of the best material, and with the present low price of farm products one shrinks from expending in improvements anything more than is absolutely necessary to secure renting the land. But even the first cost could be endured if it were not for the constant drain upon farm revenues in the way of improvement and maintenance of buildings. It is believed, therefore, that any information which could be given upon the preservation of timber, by the use of paints and cheap painting material, would prove of value and of interest.

The process of creosoting timber in order to preserve it is now in quite common use with many of the railroad companies in the South; but this method requires special and expensive machinery, and would not justify itself upon a farm. Although, if a "Central Creosote Works" were established, and all kinds of creosoted lumber kept on hand, it would no doubt find a ready sale, at even an increased cost over the mill lumber. Coal tar and pitch, applied with a brush, or by dipping the timber in the hot tar, have long been used, even since remote antiquity. It is best to boil the tar in an open pot, or kettle, until the volatile constituents are, in great part, driven off. But on thin boards or timber the tar must not be applied too hot, as there would be danger of splitting. Crude cotton seed oil applied boiling hot to timber is also an excellent preservative. These applications are especially useful upon foundation timbers, even when not exposed to the weather. They prevent "dry rot." Of course, when the use of these preservatives is admissible upon outside timbers, exposed to the weather, they become of still greater importance. But, since they are objectionable, either from the odor or appearance given to the timber, their use is, in many cases, prohibited thereby. We must, therefore, resort to paints of some kind or quality. Either the manufacture or composition of paints is so little understood by farmers in general that they are at the constant mercy of any unscrupulous dealer, who may expect to make but one sale to that particular man. Most men understand that linseed oil is the oil to be used, but they do not know so well that zinc oxide or "white lead," which is what is known by chemists as a basic carbonate of lead, are the only two chemical substances cheap enough for common use that make a first-class paint for outside work. Red or brown ocher, which are only oxides of iron, prepared either artificially or found in the native state, are frequently used for cheap paints. *Barites* is the name of a mineral occurring in great

quantities in several localities of the United States, and consists of sulphate of Barium, very much resembling certain forms of gypsum, from which plaster of paris is made, which is sulphate of lime. It can be mined in certain localities as cheaply as limestone could be taken from the ground. and is about as worthless as a paint. Still it is a very common ingredient of "white lead" and zinc paints. It is a very heavy substance, and becomes, therefore, a double cheat. It is sometimes replaced by limestone or clay, both of which are of even less value. One would not think of going out and digging up a white clay, carefully grinding it in oil, and applying as a paint to his house. But when he buys Barites, or chalk, mixed with some lead or zinc paint, if intended for outside work, the case is almost as bad. But if the purchase must be made, it is better to make it with the full knowledge of what one is buying, and to be acquainted with probable results, rather than to pay a first-class price for a second-grade paint, or a second-rate price for a third-grade paint.

In many cases it may be desirable to use a cheap paint. In that case one of the ochres should be the choice if for outside work. A still cheaper paint might be used for inside work not subject to wear.

Now as to

OILS.

Cotton seed oil is a semi-drying oil; and one of the main objects of this investigation was to make a test of the drying properties of this oil, crude or refined, and see if it could for common work replace linseed oil, either whole or in part. It is believed that any new use found for cotton seed oil is of actual benefit to the farmer. The increased use and price of the oil should stimulate directly an increase in price for the seed. Two methods were used:

(A) Boiling the oil with different drying agents in order to increase its drying properties.

(B) Treating the oil with gasoline or turpentine.

Under the first heading the following tests were made:

Sample No. 1.—Crude cotton seed oil was mixed with a one per cent caustic soda, and heated at 70 degrees for 45 minutes. It was allowed to stand 14 hours, and then treated with a three-tenths of one per cent of borate of manganese, and heated 170 degrees for one hour.

Sample No. 2.—Same as No. 1, except only one-half part of caustic soda used, and 1 per cent of lead oxide added instead of the manganese borate.

Sample No. 3.—Crude cotton seed oil was treated with a three-tenths of one per cent of manganese borate, and heated for one hour at 170 degrees.

Sample No. 4.—Crude cotton seed oil treated with one per cent of chloride of lime, and heated to 170 degrees for one half hour.

Sample No. 5.—Crude cotton seed oil heated with five per cent of lead oxide to 170 degrees for one hour.

Sample No. 6.—Refined cotton seed oil heated with caustic soda one-half per cent for five hours at 170 degrees, then for four hours at the same temperature with black oxide of manganese.

Sample No. 7.—Crude cotton seed oil treated with one per cent of nitrous acid, allowed to stand for a day; two per cent of nitrous acid added, and heated to 170 degrees.

Sample No. 8.—Crude cotton seed oil treated with on-half per cent of caustic soda, and heated for five hours at 70 degrees; then heated for four hours with manganese dioxide at 170 degrees.

Sample No. 9.—Crude cotton seed oil heated above 70 degrees with one-half per cent of caustic soda for 45 minutes.

Sample No. 10.—Crude cotton seed oil treated with one-half per cent of caustic soda, then with two and one-half per cent each of black oxide of manganese and lead acetate, and heated for one hour at 170 degrees. (Gets thick.)

Sample No. 11.—Same as No. 10, except heated one hour longer.

Sample No. 12.—Crude cotton seed oil treated with three per cent of lead oxide, and heated for one hour at 170 degrees.

Sample No. 13.—Crude cotton seed oil alone.

Sample No. 14.—Crude cotton seed oil treated with one and one-half per cent of nitrous acid, and allowed to stand 20 days.

Sample No. 15.—Crude cotton seed oil treated with one per cent of sodium hydroxide, and heated to 70 degrees for 45 minutes. Then treated with two and one-half per cent of lead oxide, and heated 130 to 170 degrees for several hours.

Sample No. 16.—Crude cotton seed oil treated with one per cent of sodium hydroxide, and heated to 70 degrees for one hour. Then treated with three and one-half per cent of lead oxide, and heated to 170 degrees or above for several hours. (Gets solid.)

Sample No. 17.—Crude cotton seed oil treated with one per cent of sodium hydroxide and heated at 70 degrees for 45 minutes. Then treated with three and one-half per cent of lead acetate, and heated for one hour at 170 degrees.

Under (B) the following tests were made:

Sample No. 18.—Crude cotton seed oil treated with five parts of crude turpentine.

Sample No. 19.—Crude cotton seed oil treated with ten parts of crude turpentine.

Sample No. 20.—Same, except 25 parts of turpentine were used.

Samples Nos. 21, 22, 23.—Crude cotton seed oil treated with five, ten, and twenty-five parts respectively of gasoline.

The above ingredients were carefully ground and mixed by hand with a good quality of "white lead." The paints so prepared were then spread with a camel's hair brush evenly and smoothly upon native pine boards, and exposed to the sun to dry. The following results were obtained:

Sample No. 3 dried in six and one-half hours, and gave the best results.

Sample No. 15 gave the second best results. Sample No. 17 was third, and No. 6 was fourth in results, all were exposed in a manner similar to No. 3. While these samples all dried in the above time, none of them became as firm and hard as a linseed oil paint treated in a similar manner. Samples 2 and 5 were good after drying in the sun

two days. No. 4 was nearly dry after eight hours in bright sunshine. Nos. 1, 7, 13, and 14 required six to eight days for drying. Nos. 5, 10, 11, 12, and 18 were unsatisfactory and could not be used. Nos. 3 and 4 were very dark, and Nos. 1, 2, and 8 were very light. In general, samples treated with turpentine and gasoline were unsatisfactory; although Nos. 19 and 21 were fairly dry after eight hours drying in bright sunshine. No opportunity was afforded to try the effect of weathering on these paints, but it is believed that those that dried most satisfactorily will resist the weather of this climate quite as well or even better than linseed oil paint. This belief is based on the well known fact that linseed oil paints are liable to crack and scale, as the result, apparently, of our long hot summers. But the cotton seed oil, while giving less gloss and hardness to the paint, seems much more tenacious. Crude cotton seed oil without any chemical treatment is frequently mixed with paints intended for outside work. But in addition to slow drying, the oil generally "runs," and makes it difficult to put the paint on smooth. But when treated as samples Nos. 3, 15, 17 or 6 were treated, there is no reason that I can see why cotton seed oil should not supplant lindseed oil for all common outdoor work. This treatment can be made by any one. The chemicals, except manganese borate, can be had of any druggist at a trifling cost, and any druggist can in a few days time obtain the manganese borate. The heating and boiling can be made in an open kettle, only using a little care to control the fire. But when a contract is made for linseed oil, the buyer should be protected against adulteration with cotton seed oil. The following test for a good linseed oil is very reliable and can be easily made by any one: Cover a piece of ordinary window glass with a thin film of the oil and expose to a temperature of about 100 degrees F. The time required for drying is a measure of the quality of the oil; if the oil has been extracted from unripe or impure seed, or if it has been adulterated with either an animal or vegetable non-drying oil, the surface of the test glass will remain "tacky" or sticky for some time. (Terry.) Sometimes rosin is added. This makes the oil thick and darker in color than pure oil. "Raw linseed oil dries more slowly than the boiled, but gives a better luster, and is more durable. It is frequently better, therefore, to mix the raw and boiled oil for use.*

COMPOSITION OF PAINTS.

In order to give some idea of the composition of paints actually on the market, several samples were purchased in Bryan and subjected to analysis, as shown in table below. It will be noticed that in the sample of "American Pure White Lead" there was 66.79 per cent of barites and

* When not otherwise expressed, the Centigrade thermometer is referred to in this Bulletin. The zero mark of this thermometer is put at the freezing point of water; while the boiling point of water indicates a temperature of 100 degrees. On the Fahrenheit scale, as well known, 32 degrees marks the freezing point of water, and 212 degrees the boiling point. To convert degrees of the Centigrade scale into that of the Fahrenheit, multiply the Centigrade degrees by 9, divide the result by 5 and add 32.

only 9.81 per cent of "white lead," and 15.59 per cent of zinc oxide. In the second sample, labeled as "Pure White Lead," the barites amounted to 74.5 per cent. Of course the manufacturer is careful not to attach his name to a sample of paint like either of these. Nos. 3, 4, 10, 11, 12 and 13 are all good paints. Of course there might be a variation of as much as 2 or 3 cents a pound between the poorer and better qualities of these paints; but, after all, the oil had to be paid for, and nothing but a *good* pigment should ever be incorporated with it. According to Church, the best "white lead" contains about 70 per cent of lead carbonate, intimately mixed with 30 per cent of lead hydrate. If the hydrate is increased, the opacity of the paint is diminished. If it goes much below, the binding power and working quality are diminished. Paints have deteriorated not only on account of adulterations, but also on account of methods of making. White lead, for example, by the old and slow Dutch or Stack process, is still considered to be the most desirable as a paint, although many newer and more rapid processes give a "white lead" of practically the same chemical composition.

As an example of a cheap paint of fair quality, it may not be out of place to mention that specified by the Pennsylvania Railroad Company for their freight cars. (Eng. Chem., p. 461; Stillman). Red ocher, 50 per cent by weight; gypsum, or hydrated calcium sulphate, 45 per cent by weight; calcium carbonate, 5 per cent by weight. Seventy-five per cent of this mixture is treated with 25 per cent of raw linseed oil, both by weight. This would be improved if the calcium carbonate were omitted and the red ocher increased.

Analysis of Commercial Paints.

Name of paint.	American Pure White Lead.	"Pure White Lead."	"Acme" Decorative Paint—white.	"Red Lead"—pure.	"Family Paint."	Acme Decorative Paint—red.	Ready Mixed Paint—pure, inside work.	Economy Paint—ready for use.	Wagon and Implement Paint—red.	Light Gray Paint—strictly pure.	Lead Carbonate—"Commercial" C. & A.	Linseed Oil Paint—ready mixed—pure.	Pure White Lead—in oil.
Lamp black	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.75	.....	.....	.....
Loss on ignition	.....	.....	.....	.....	.....	.....	.....	24.1	.....	.....	.....	3.02	.....
Manganese dioxide	.....	.....	.....	.....	16.65	.....	.....	7.27	.....	.....	.....	.....	.....
Red lead	.....	.....	.....	99.36	.....	.....	.....	.....	.....	.....	.....	.....	.....
Iron oxide	.....	.....	.....	.12	6.88	.....	3.1	9.56	5.4	.....	.....	.....	.....
Limestone	.....	0.32	0.93	.....	37.44	.....	40.27	7.6	44.39	.....	.....	.....	.....
Barium sulfate, "heavy spar."	66.79	74.2	14.3	.....	.....	56.2	14.57	.....	.....	.....	.....	.....	.....
Sand and clay	7.69	11.04	0.4	.....	2.57	0.65	0.23	5.9	9.02	.....	.....	2.98	.....
Gypsum, "plaster"	0.36	.....	.....	.....	.....	0.5	0.8	.....	1.11	.....	.....	.....	.....
Lead sulfate	0.34	Trace.	0.75	.....	.....	0.23	.....	.....	.....	4.52	.....	3.55	.....
"White lead," basic carbonate.	9.81	1.63	35.47	.....	.....	41.5	.....	1.89	39.26	28.78	99.4	8.16	99.00
Zinc oxide, "zinc white"	15.59	13.26	48.7	.....	35.92	.....	40.6	34.72	.....	64.9	.....	82.24	.....
Metallic lead	.....	.....	.....	.52	.....	.....	.....	.....	.....	.....	.....	.....	.....
Number	1	2	3	4	5	6	7	8	9	10	11	12	13
Manufacturer's name and address.	Ground in bleached oil, St. Louis, Mo.	Ground in pure linseed oil, no name, New York.	Acme White Lead and Color Works, Detroit, Michigan.	Carter White Lead Works, Omaha, Nebraska.	Sherman, Williams & Co., Chicago.	Acme White Lead and Color Works, Detroit, Mich.	F. C. Knowles & Co., New York.	Charles Moser & Co., Cincinnati, Ohio.	Sherman, Williams & Co., Chicago.	Mound City Paint and Color Co., St. Louis.	Eimer and Amend.	Dubuque Linseed Oil Paint Co., Dubuque, Iowa.	Southern White Lead Co., St. Louis and Chicago.

CONCLUSIONS.

Cotton seed oil, crude or raw, can be used for rough outside work, in summer weather. Either red or yellow ocher is the best mineral material to incorporate with it. The oil can be much improved by incorporating a "dryer," as described above. When so prepared, it can be used with even the best "white lead" or "zinc white." But in no case will cotton seed oil give the lustre or hardness given by linseed oil. Its durability may, however, be even better. It is cheaper, and less liability for fraud to buy the oil and pigments separately and mix them to suit, rather than to buy the ready mixed paints. A ready mixed paint that does not have the manufacturer's name and address on the can should never be purchased; but even this precaution is not always a guaranty of the quality of the paint.

Buy from a reliable dealer, but remember that even he may be deceived; so that a guarantee of the chemical composition of the paint should be given.

MISCELLANEOUS WORK.

The Department feels called upon to do a great amount of miscellaneous work for the public, that might be omitted if there were a private laboratory in the State, to which such work could be sent. But, being far removed from the large cities, it would be a great inconvenience, if not an actual deprivation of rightful services, to deny applications for this kind of work. Under certain minor restrictions, therefore, we analyze waters, soils, feed-stuffs, oils, ores, and minerals; anything, almost, except medicines and poison cases, which would likely involve testimony in court.

THE MINERAL WATERS

Of the State are as varied as the many types of soil; and it seems to me that there is not one but many wells or springs which duplicate some one of the famous waters reported from other States and other countries. Below are given in tabular form the analyses of thirty-six samples; most of them mineral waters.

As a rule the artesian wells of the State, of which there are very many, are strongly mineral in character; but a notable exception to this is that from Dimmit county, which has only 29.4 grains of mineral matter to the gallon. This water is used for irrigation, for which it is admirably adapted. It is situated about 500 feet from the mineral spring at the same locality. There are some 40 or 50 artesian wells in Dimmit county, and this is reported as a fair type of all of them. It is only 125 feet deep. The water from Laredo comes from a well 250 feet deep; it has little in it, except sodium chloride and sodium carbonate.

The water from Valley View is described as coming from a depth of about 250 feet in a bed of gray sand. In boring, five strata are passed through, each from 40 to 50 feet in thickness; soil and underlying limestone, then 40 feet of blue rock and shale, limestone again, then gray sand, hard limestone, and fine gray sand, from which comes an abundant supply of water; but not always flowing. The water is characteristic of the artesian waters of that locality.

The water from Barstow was sent to find if it could be used in a beet sugar factory. In the manufacture of beet sugar, a water free from the alkaline chlorides is necessary, as these prevent the sugar from crystalizing. The water is rather high in total mineral matter, but is practically free from chlorides. The water from Texas City is used for irrigation and is very well adapted to that purpose. That from Cotulla was wanted also for irrigation, but would in time prove injurious to the soil.

Table of Analyses.

Address and remarks.	Artesian, Dimmit county.	Denison.	Terrell for boilers.	Crockett.	El Paso. Irrigation.	Barstow sugar beets.	Texas City artesian, alkaline.	Hubbard.	High Island, Galveston, acid.	Huntsville Well No. 2, alkaline.	Huntsville Well No. 3, alkaline.	Belcherville Cotton Oil Co.	E. M. Overshiner, Valley View.	Stanley Turner, San Angelo.	E. L. Bacon, Beaumont.	W. R. Cavitt, Bryan.	Tom Batte, Bryan.	E. E. Brougher, of Hughes Springs.
Potassium Chloride	...	...	...	1.90	2.38	...	0.83	...	1.66	1.49	1.04	...	...	.84	...	3.81	...	...
Sodium Chloride	2.29	3.08	4.53	174.53	20.32	1.42	26.90	292.	5.81	6.14	6.48	264.2	7.32	1.66	5.09	55.9	270.8	0.5
Magnesium Chloride	2.17	...	...	44.56	5.54	...	0.94	...	...	...	...	...	...	...	...	22.01	11.06	...
Magnesium Sulphate	4.47	2.46	...	...	12.14	1.44	...	6.6	2.21	0.85	1.34	2.10	.25	24.09	7.69	...	...	0.27
Calcium Sulphate	...	5.07	...	...	28.61	23.61	*...	49.3	10.80	...	...	3.72	.99	12.58†	18.91	19.82‡	11.78	1.09
Sodium Sulphate	...	32.32	4.14	...	...	...	...	195.	4.15	1.55	...	1.82	12.72	...	11.05	...	27.88	4.90
Calcium Bi-Carbonate	...	...	10.26	...	...	12.34	...	...	...	12.79	6.10	...	...	53.16	4.65	...	...	...
Sodium Carbonate	18.73	...	5.62	...	15.97	1.20	31.11	110.4	...	6.26	2.85	15.7	35.53	39.46	6.48	18.00	13.94	...
Magnesium Carbonate	...	...	0.97	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Silica—Sol. and Insol	1.38	2.81	...	...	2.11	1.48	...	...	1.91	5.22	2.45	1.48	1.51	4.48	5.60	8.5	...	0.14
Potassium Sulphate	...	1.55	...	...	...	...	...	10.1	...	...	...	...	...	...	...	...	...	0.76
Iron Proto-Sulphate	...	0.63	...	14.40	...	...	0.67	20.2	3.53	...	...	...	...	...	0.45	1.50	...	...
Aluminum Sulphate	...	...	...	34.92	...	...	...	...	3.51	...	...	...	...	...	...	3.90	...	...
Manganese Chloride	...	...	...	20.00	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total mineral matter	29.4	50.00	26.46	...	87.92	43.4	62.63	683.6	...	35.00	28.98	288.92	59.67	146.00	60.00	182.00	333.5	7.66
	J. A. Daugherty.	B. C. Murray.	M. C. Roberts.	J. E. Monk.	J. S. Porcher.	Geo. E. Briggs.	C. L. Crandall.	C. Smith.	Geo. E. Smith.	J. S. Rice.	J. S. Rice.	Sulphur water.	Artesian, 250 feet, weak flow.	Alkaline reaction.	Alkaline reaction.	Bored well.	Artesian, Brazos bottom.	A remarkably pure water.

*Cacl$_2$. 0.75. †CaCl$_2$. 3.55. ‡CaCl$_2$. 48.50.

Table of Analyses.

Address and Remarks.	Denison.	Laredo.	Gainesville. C. S. Oil Co.	Kosse.	Waco.	Goliad.	Palmer. Alkaline.	Troy. Slightly alkaline	Hempstead.	Corpus Christi.	Cotulla. Irrigation.	Corsicana. Artesian.	A. J. Stovall. No. 1 Terrell.	Terrell. No. 2 Stovall.	Midlothian.	Welch, Texas.	Waxahachie. Artesian.	Carrizo Springs, Dimmit county.
Iron Proto Sulfate														68.61				
Potassium Chloride	0.244						2.54				2.48		1.00	5.95	2.70		0.70	5.50
Manganese Sulfate														26.34		0.53		
Sodium Chloride	1.19	394.6	1.70			14.02	49.48	46.00	1.90	1385.2	168.47	273.59	67.32	52.25	11.38	1.09	12.94	467.67
Magnesium Chloride				13.00		9.04				35.6		1.81					0.44	
Magnesium Sulfate	.90	.65			32.06		1.26				60.00		13.86	87.90	3.05			231.00
Calcium Sulfate	10.9			57.6	25.25	3.89				39.8	38.17		26.14	140.71			0.88	130.4
Sodium Sulfate	2.93		2.88		130.28		28.66	40.36			49.40		34.09	32.25	37.48	0.35	24.39	390.6
Calcium Chloride						3.72				49.9		2.50						
Calcium Carbonate	10.93	3.6	1.00			15.82	1.56	3.00	15.8						10.02	1.05		
Silica	1.25		2.10			3.15	1.44				10.22	1.99	1.50	90.23		4.20	0.94	0.71
Sodium Carbonate		30.7	24.93	14.00	88.00	11.11	55.14		1.15		20.07	83.90	13.70		16.80	2.15	45.93	80.3
Magnesium Carbonate		1.07	.43						4.25							0.87		
Aluminum Sulfate														732.37		1.75		
Iron Carbonate			1.72													1.52		
Soda Alum				111.46														
Total Mineral Matter	9.30		35.00			61.32		90.00	23.10		328.81	364.28		1257.6	79.10	12.56	87.50	1302.5
Remarks.	M. A. Jackobs.	E. H. Souvignet.	Boilers.	M. W. Smith.		Jno. Woodhead. Boilers.	R. M. Johnson.	C. L. Myers.	E. Crew.	F. H. Dennis.	D. Flint.	Jas. L. Autry.	Alkaline.	Suspended clay.	Dillard, W. G. C.	N. Johnson.	E. A. Du Bose.	J. A. Daugherty.

DISTILLATION OF BY-PRODUCTS FROM LIGNITE-TAR.

Two light black, watery products from lignite-tar were sent for examination, and gave the following results:

Boiling point when received: No. 1, 94 degrees; No. 2, 81 degrees. Distilled at 75 to 150 degrees, No. 1 gave off 63.5 per cent of its volume, the distillate boiling at 95 degrees; consisted mainly of water, with a small amount of light oils. After this water was driven off, there came, at the same temperature, 9.3 per cent of a yellowish red oil, boiling at 85 degrees. When the temperature was raised to 120 to 320 degrees, a dark red oil, boiling at 95 degrees, and constituting 12 per cent of the original volume, was obtained. Above 320 degrees, 5.3 per cent of a thick, dark oil, somewhat resembling resin oil, was obtained, leaving a charcoal residue of 9.9 per cent.

No. 2 was darker in color, and contained more tar. Distilled at 75 to 110 degrees, it gave off 41 per cent of its volume; of the same watery white liquid as that of No. 1. It had a boiling point of 97 degrees. After this, there came over at the same temperature 12.8 per cent of a yellowish red oil boiling at 78 degrees. (Light oils.)

From 120 to 260 degrees, 10 per cent of a darker oil came over. And from 260 to 320 degrees, 12.8 per cent of a dark oil was driven over; and above 320 degrees a darker oil, resembling rosin oil, 12 per cent in amount, was obtained, leaving 11.2 per cent of residue. The distillates from both samples 1 and 2 might be classed as *Light Oil, Heavy Oils,* and *Rosin Oils.* They have a very strong empyeumatic odor, which is very difficult to remove. When removed, the Light and the Heavy oils might be used as solvents, and the Rosin oil used to adulterate lubricating oil.

COTTON SEED MEAL.

(Damaged.)

Sent on from Ennis to be examined as to feeding value. No. 1 is from Ennis; No. 2 is the average of 35 analyses:

	No. 1. Per ct.	No. 2. Per ct.
Moisture	12.5	8.2
Ash	11.45	7.2
Protein	52.5	42.3
Crude fiber	3.75	5.6
Fats	11.0	13.1

There was an excess of moisture and mineral matter in the damaged sample, as well as a large amount of protein, but there was a decrease of fats.

COALS.

Samples of lignite for analysis are frequently received. Below are given types of these from different localities, as well as a sample of *Coke* from wood tar, and a sample of Bituminous coal from Corsicana.

No. 1 is lignite from Crockett; No. 2 from Burleson county, and No. 3 from Millican. No. 4 is Coke from lignite-tar, and No. 5 is Bituminous coal sent from Corsicana, but probably found outside the State. No. 6, lignite from Burleson county.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
Moisture	18.62	15.24	24.00	4.04	3.09	33.8
Volatile and combustible matter	46.00	45.68	38.2	33.67	38.18	44.4
Coke—fixed carbon	28.62	15.50	18.61	48.9	53.40	13.07
Ash—or mineral matter	5.25	21.77	17.75	13.17	5.07	7.16
Total sulfur	1.00	0.7	1.12	.....	0.26	1.5

No. 1, from Crockett, is a lignite of splendid quality. It has a rich black color, and is remarkably low in ash or mineral matter, with a large amount of coke or fixed carbon.

COPPER ORES.

From Brackenridge, Texas, and from Mexico. Nos. 1, 2 and 3 from Texas; No. 4 from Mexico:

	No. 1.	No. 2.	No. 3.	No. 4.
Metallic copper	26.15	2.45	1.05	13.56
Iron oxide	.....	.....	.....	8.96
Silica and sand	.....	.....	.....	37.16

Under favorable circumstances, a copper ore as low as 6 per cent of metallic copper can be worked with profit.

IRON ORES.

From Buffalo, Texas:

	No. 1. Per ct.	No. 2. Per ct.
Metallic iron	53.0	28.0
Silica and sand	17.6	51.5
Sulfur	0.26	0.20

No. 1 is a very good ore, except for the rather large amount of sulfur which it contains.

CLAYS.

No. 1 is from Mt. Pleasant, and No. 2 is from Millican, Texas:

	No. 1. Per ct.	No. 2. Per ct.
Sand and silica	52.68	78.2
Oxide of alumina	33.36	15.2
Oxide of iron	1.28	.....
Alkalies as sulfates	.....	6.35

No. 2 is of no value as a clay, but it, along with several other clays found in Brazos and Grimes counties, contain potash enough to make them of value as a fertilizer in their immediate localities. It would probably not pay to transport the clay to any great distance. Its use on light leachy soils (sandy or gravelly) would be especially beneficial.

FERTILIZER.

From Galveston. Air dry.

	Per ct.
Silica and sand..) Insoluble matter.)	58.8
Potassium oxide	0.98
Phosphoric acid	.16
Nitrogen	1.18

This was a manure from the stock yards of Galveston, and exposed for some time to the action of the weather.

CALCAREOUS SHELLS.

From Houston. Sent to be examined as to their value for fertilizer purposes.

	Per ct.
Calcium carbonate	87.1
Potassium oxide	3.19
Phosphoric acid	0.35

This material would be of value only where lime or lime carbonates would be indicated to help the mechanical condition of the soil.

ASPHALTS.

No. 1 is from Corpus Christi, and No. 2 is from Dallas.

	No. 1. Per ct.	No. 2. Per ct.
Petrolene	47.66	31.06
Ashphaltine	48.58	11.60
Total bitumen	96.24	44.66
Organic matter—		
Not bitumen	3.56	15.54
Mineral matter	1.19	39.80

ASHES.

From lignite coal.

	No. 1. Per ct.	No. 2. Per ct.
Moisture	1.45	1.50
Calcium oxide	22.40	16.24
Phosphoric anhydride	0.35	0.08
Potassium oxide	0.59	0.50

No. 2 was not well burned and was full of charcoal.

SATOL.

From Dull's Ranch. No. 1 is the analysis of the whole plant. No. 2 is the anaylsis of the *heart* of the plant. The latter constitutes perhaps one-third of the entire plant. It is soft and white, tender and very brittle.

	No. 1. Per ct.	No. 2. Per ct.
Fats	2.18	3.45
Crude fiber	34.4	10.10
Protein or albuminoids	7.03	10.72
Nitrogen—free extract	50.38	71.41

The above is the anaylsis of the plant in the Water Free condition. The green plant contains 69 per cent of water; while the heart of the green plant contains 73.6 per cent. While in the air dry plant there occurs 16.26 per cent of water, and 18.7 per cent in the heart. The following is the analysis of the plant in the green state. No. 1, whole plant; No. 2, heart of plant.

	No. 1. Per ct.	No. 2. Per ct.
Fats	0.67	0.91
Crude fiber	10.66	2.66
Protein	2.17	2.83
Nitrogen—free extract	15.61	19.88

In chemical composition, this is a somewhat better feed stuff than turnips. But it is probable that it is not so digestible as turnips are.